

**Biological Control of the Mexican Bean Beetle
Epilachna varivestis (Coleoptera: Coccinellidae)
Using the Parasitic Wasp
Pediobius foveolatus (Hymenoptera: Eulophidae)**

2013



Mexican bean beetle adult



P. foveolatus on larva

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SCOPE AND COVERAGE

In 2013, the Mexican bean beetle (MBB) *Epilachna varivestis* (Coleoptera: Coccinellidae) biological control program involved 31 growers and 40 survey locations. Due to the success of the Mexican bean beetle (MBB) nurse plot program in previous seasons, change in the growers' herbicide regimens, the Phillip Alampi Beneficial Insect Laboratory did not plant or monitor nurse plots in 2013. The nurse plots had served as trap crops in the past luring the overwintering Mexican bean beetle to the plots where the parasitic wasp, *Pediobius foveolatus*, was released. Due to an aggressive parasitoid release program over the last 30 years, we now feel confident that we can maintain pressure on the Mexican bean beetle population with direct field releases in the areas most susceptible to the Mexican bean beetle. In 2013, ten out of 25 growers who were contacted did not want nurse plots because of weed problems and most of the other growers would just as soon do without them. Those growers who did agree to the plots also voiced concerns about the buildup of weeds.

Growers use Roundup® after the soybeans have germinated and Roundup® is more effective and convenient to use than the herbicide regimens of the past. Most growers have their fields sprayed with Roundup® about three weeks after the nurse plots are planted and oftentimes the nurse plot is accidentally sprayed, killing the snap beans. Without the snap beans the plot's value as a trap crop to attract overwintering Mexican bean beetles is eliminated and hinders the gathering of efficacy data. Little meaningful data from the plots has been obtained since the introduction of Roundup® ready beans. When pre-emergent herbicides were used by the growers in the past, the Phillip Alampi Beneficial Insect Laboratory would get their benefit, as the plots were moved around every year resulting in lower overall weed populations. There is no satisfactory weed control with the currently registered herbicides that are labeled for both snap beans and soybeans.

MATERIALS AND METHODS:

A total of 40 strategic release locations were selected by field staff to obtain the greatest coverage possible in the state. All of the areas selected had a history of Mexican bean beetle pressure and it was hypothesized that releases in these areas would be the most effective way to mitigate the Mexican bean beetle population without the nurse plots. The vast majority of the sites were in the inner coastal plain which is located from Salem and Cumberland Counties north through Monmouth and Middlesex Counties. The adult parasitoid, *Pediobius foveolatus* (Hymenoptera: Eulophidae), was released into the sites where female wasps attack or "oviposit" on all larval instars (1st through 4th) of the Mexican bean beetle. A single female *P. foveolatus* deposits an average of 25 eggs within each MBB larva. After 5 to 7 days parasitized larvae die, forming dark brown "mummies" (Figure 1). An average of 25 wasps (70% -75% female), successfully develop and emerge from each parasitized MBB larva. Newly emerged female wasps mate and readily disperse from the release sites to search for MBB larvae in adjacent soybean fields.

The goal of the program was to release a minimum of 8,000 parasites, depending on their availability, in each of the fields. Each field was surveyed once per week throughout the peak Mexican bean beetle season resulting in six field surveys per site. Few Mexican bean beetle were observed and no numerical data were collected due to time and personnel constraints.

If Mexican bean beetle were observed in a field then that field received additional releases of *P. foveolatus*.

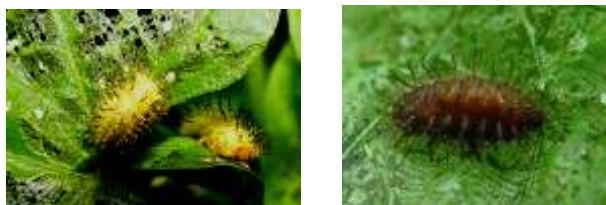


Figure 1. Mexican bean beetle larva and parasitized larva (mummy)

RESULTS AND DISCUSSION

Table 1 shows the number of parasites released in the survey sites. A total of 336,000 *P. foveolatus* were released in those sites during 2013 with an average of 8,297 wasps released per site. In Figure 2 those sites are indicated on the map by the green circles. The black stars in Figure 2 indicate areas where field releases were made in areas where a Mexican bean beetle population could develop. These additional field releases totaling 270,500 parasites (Table 2) were made to keep up the environmental resistance on the Mexican bean beetle population. Direct field releases were also made into snap bean and lima bean fields throughout Central and Southern New Jersey wherever MBB were observed. The purpose of the *P. foveolatus* releases is threefold: 1) to suppress the MBB in areas where it could potentially reach damaging levels, 2) to reduce the over wintering MBB population and 3) to utilize surplus *P. foveolatus* laboratory stocks. Using *P. foveolatus* as a biocontrol agent has resulted in substantial savings to the growers in reduced insecticide costs as well as reduced environmental pollution.

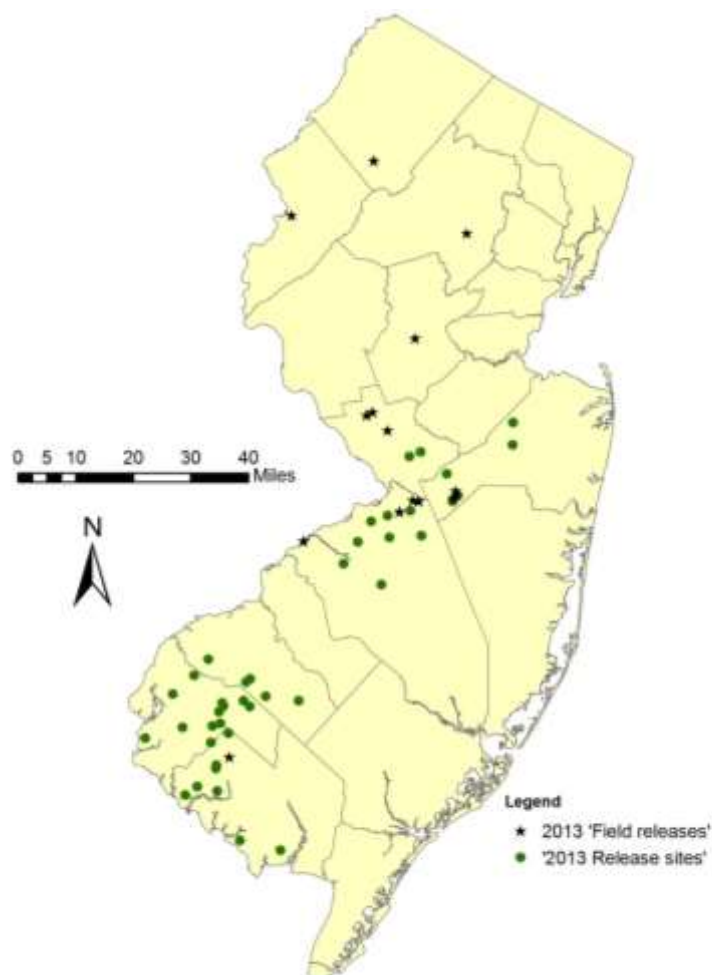
The weakness in the 2013 procedure is that there were no nurse plots so it was difficult to determine exactly where and at what levels the Mexican bean beetle populations were. The indication from the field surveys is that the Mexican bean beetle population in the state is low especially in South Jersey because few were observed in any soybean fields. Some *e. varivestis* adults and larvae were observed in Western Monmouth and Northern Burlington Counties but there were no signs off a burgeoning population.

TABLE 1. RELEASE SUMMARY BY COUNTY 2013

County	Total No. of sites	No. of Surveys	Total No. of Parasites Released	Average No. of <i>P. foveolatus</i> Released per Site
BURLINGTON	8	48	76,000	9,500
CUMBERLAND	9	54	68,000	7,555
GLOUCESTER	5	30	40,000	8,000
MERCER	2	12	16,000	8,000
MONMOUTH	5	30	40,000	8,000
SALEM	11	66	96,000	8,727
TOTAL	40	240	336,000	
OVERALL AVERAGE				8,297

TABLE 2. FIELD RELEASE SUMMARY 2013

County	#Field Releases	# <i>P. foveolatus</i> Released
Burlington	11	94,000
Cumberland	1	16,000
Mercer	6	84,000
Monmouth	4	34,000
Morris	1	4,000
Somerset	1	20,000
Sussex	2	12,500
Warren	1	6,000
TOTAL	27	270,500

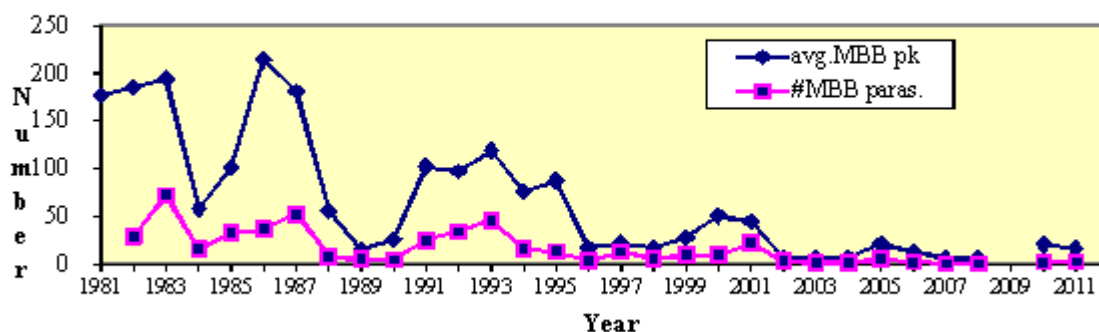
Figure 2. *Pediobius foveolatus* Release Sites and Field Releases

Mexican Bean Beetle (*E. varivestis*) Population Levels

Figure 3 shows the "host peak" (a measure of the Mexican bean beetle population) and the number of hosts parasitized in the nurse plots for the years 1981-2011. Although there is no data, for the 2009, 2012 and 2013 seasons the figure is included to demonstrate the decline of the in the Mexican bean beetle population over 20 years. There have been fluctuations in *E. varivestis* populations since 1981 and the number of *P. foveolatus* released has closely followed this trend. Insect populations are cyclical and the MBB populations shown in Figure 3 are no exception. The key observation in is that peak MBB populations in the 1990's were 50% of what they were in the 1980's and the present populations are roughly 12-13% of the pest populations of the 1980's. The Mexican bean beetle population is still at historic lows and one year without nurse plots should not substantially increase the MBB population.

MBB population "hot spots" can still occur and are usually located in areas where nurse plots have not been planted and maintained for several years. Salem County's increase in the 1990's was possibly due to MBB migration from neighboring states. In the late 1990's the increase was due to population increases in central Monmouth County where no nurse plots or releases had been made. Data over the years suggest that *Pediobius* releases by the New Jersey Department of Agriculture have dramatically reduced MBB populations statewide.

**Figure 3. Mexican bean beetle Population and Parasitism
1981-2012**



In 2013, field staff found four "hot spots" of Mexican bean beetle activity: 1) Upper Freehold in Monmouth County 2) Chesterfield in Burlington County, 3) Springfield in Burlington County and 4) Pennington in Mercer County. These areas will receive inundative releases of *P. foveolatus* throughout the 2014 season in order to prevent the second generation of the Mexican bean beetle population from reaching economically damaging levels.

SUMMARY AND CONCLUSION

Overall in 2013 MBB populations continue to remain low in all counties with no outbreaks observed. The continuing release of *P. foveolatus* should keep MBB populations from returning to levels that growers experienced in the past. The fact that no nurse plots were planted in 2013 should not materially affect the MBB population in 2014.

A total of 606,500 *P. foveolatus* were released in NJ and no grower had to treat soybeans for the Mexican bean beetle.

A portion of the soybean check-off funds reserved for research has been allocated to the NJDA by the New Jersey Soybean Board and is used to offset some of the costs for *P. foveolatus* rearing, field implementation and scouting. MBB populations have been successfully kept below economically damaging levels in areas where nurse plots are maintained. Many more acres of soybeans and snap beans are protected due to the widespread dispersal of the parasitoid. Additionally, there is no economic impact on the growers from the possibly more damaging second-generation MBB population. The peak populations have continued to decline over the past quarter century and over the same time period, the Mexican bean beetle populations have been held at a manageable level as a direct result of the New Jersey Department of Agriculture's biocontrol program.